REMARKS

Response to Objections

As noted above and regarding paragraph 1 of the Office Action, Applicant has amended the title of the invention to be clearly indicative of the invention to which the claims are directed.

Regarding the claim objections, claims 23, 27, 29 and 30 have been amended and claims 28 and 31-32 have been canceled.

Response to Claim Rejections Under 35 U.S.C. § 102(b)

The following issue is presented: Whether claims 1-5, 10-13 and 15 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 6,025,699 by Cummings. If examination at the initial stage does not produce a prima facie case of unpatentability, then without more, the applicant is entitled to the grant of the patent. See *In re Oetiker*, 977 F. 2d 1443 (Fed. Cir. 1992). Under 35 U.S.C. § 102, anticipation requires that there is no difference between the claimed invention and reference disclosure, as viewed by a person of ordinary skill in the field of the invention. See *Scripps Clinic & Research Foundation v. Genentech, Inc.*, 927 F.2d 1565. Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. In deciding the issue of anticipation, the trier of fact must identify the elements of the claims, determine their meaning in light of the specification and prosecution history, and identify corresponding elements disclosed in the allegedly anticipating reference. *See Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452.

In the present case, the Office asserts that Applicant's claims 1-5, 10-13 and 15 are set forth in Cummings. As more fully set forth below, Applicant contends that the findings of anticipation by the Office are clearly erroneous based on a failure to identify the elements of the claims, to determine their meaning in light of the specification, and to identify corresponding elements

disclosed in the allegedly anticipating reference of Cummings. Applicants contend that the Office has not shown the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Therefore, the rejection of these claims should be withdrawn.

It should be noted that the differences between Applicant's invention and the Cummings reference arise from the fact that the Applicant's claimed invention provides a measure of cold-cranking current or amperage capability of a storage battery without significantly discharging the battery, while the Cummings reference provides a method for preventing overcharging a battery during a charging operation by discharging the battery. Applicant's invention operates by periodically applying a low resistance of the order of 10^{-3} ohms for a momentary time period of the order of 10^{-5} seconds across the battery terminals while measuring the instantaneous current through the low resistance. The instantaneous current through the low resistance is an indication of the cold-cranking amperage or current capacity of the battery. The Cummings references discloses a method to prevent over-charging a battery by discharging a battery on a continuous basis during a battery charging operation, while Applicant's disclosure reveals a method for determining cold-cranking amperage using a short duration, instantaneous current measurement that prevents discharging of a battery.

The Cummings reference discloses a method for preventing over-charging a battery. It accomplishes the over-charge protection by measuring the temperature of the battery, the charging voltage and the charging current during the battery charging process. If the battery temperature, charging voltage and charging current are indicative of an unsafe battery charge level, a shunt circuit is applied across the terminals of the battery until the battery charge level is reduced to a safe level. There is no teaching in the Cummings reference of determining cold-

cranking amperage or current of a battery. For operation of the Cummings invention, a battery must be under a charging condition, which is unnecessary in Applicant's invention.

Since the Office has failed to establish that there is no difference between the Applicant's claimed invention and the disclosure of Cummings, Applicant requests withdrawal of the rejections and reconsideration of the patent with respect to the above-referenced claims.

CLAIM REJECTIONS OF INDEPENDENT CLAIM 1 UNDER 35 U.S.C. § 102(b)

The result produced by Applicant's claimed invention and the result produced by that disclosed in the Cummings reference are patentably distinct from one another. That is, the means of accomplishing the result and the result in the two disclosures are distinguishable from one another. This is evidenced by the fact that every element of Applicant's claimed invention, arranged as in the claims, is not found in the Cummings reference cited by the Office.

Preamble: Turning to the preamble of Applicant's independent claim 1, as amended, which recites, "Apparatus for monitoring the condition of a lead-acid storage battery by assessing its cold-cranking amperage…" There is no teaching in Cummings of assessing the cold-cranking amperage of a battery. There is no teaching in this citation of the preamble of Applicants' claims 1, 17 and 29.

Third Claim Limitation: Turning to the third limitation of Applicant's independent claim 1, as amended, which recites, "characterized in that the switching means is connected in series with a resistance of order 10^{-3} ohms and operates to complete the circuit periodically". There is no teaching in Cummings of this claim limitation. The comparison by the Office of Applicant's claim limitations to identified reference designations in figures in the Cummings does not result in identifying the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. There is no relevance between the Cummings reference citations by the Office and Applicant's claim 1. There is no teaching in the Cummings

reference of a switching means in series with a 10^{-3} ohm resistor that operates periodically. There is no teaching in this Office citation of the third limitation of Applicant's claim 1. Therefore, there is no anticipation under 35 U.S.C. § 102(b) and Applicant requests that the claim rejection be withdrawn.

Fourth Claim Limitation: Turning to the fourth limitation of Applicant's independent claim 1, as amended, which recites, "the voltage measurement means operates to measure the potential across the resistance during current flow and thereby determine the current flowing through the resistance using Ohm's law". There is no teaching in Cummings of this claim limitation. The comparison by the Office of Applicant's claim limitations to identified reference designations in figures in the Cummings does not result in identifying the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. There is no disclosure in the Cummings reference of measuring the voltage across a resistor to determine current flow. There is no relevance between this Cummings reference citations and Applicant's claim 1. There is no teaching in the Office citation by the Office of the fourth limitation of Applicant's claim 1. Therefore, there is no anticipation under 35 U.S.C. § 102(b) and Applicant requests that the claim rejection be withdrawn.

Fifth Claim Limitation: Turning to the fifth limitation of Applicant's independent claim 1, as amended, which recites, "the period during which the switching means is closed is of the order of 10^{-5} seconds; wherein the current drawn during each closure is of the same order as the short-circuit current of the battery, whereby the instantaneous current determined as flowing through the resistance is indicative of the cold-cranking amperage of the battery." There is no teaching in Cummings of this claim limitation. The comparison by the Office of Applicant's claim limitations to identified reference designations in figures in the Cummings does not result in identifying the presence in a single prior art reference disclosure of each and every element of

the claimed invention, arranged as in the claim. There is no relevance between this Cummings reference citations and Applicant's claim 1. Cummings does not disclose a switching period of 10^{-5} seconds, nor that the switch closure current is indicative of the cold-cranking amperage of the battery. There is no teaching in the Office citation by the Office of the fifth limitation of Applicant's claim 1. Therefore, there is no anticipation under 35 U.S.C. § 102(b) and Applicant requests that the claim rejection be withdrawn.

CLAIM REJECTIONS OF DEPENDENT CLAIMS 4-5, 10-13, AND 15 UNDER 35 U.S.C. § 102(b)

It is shown above that independent claim 1, as amended, is not anticipated by the Cummings reference under 35 U.S.C. § 102(b). Dependent claims 4-5, 10-13, and 15 are dependent on claim 1, and incorporate all the limitations of claim 1. Therefore, dependent claims 4-5, 10-13, and 15 are also not anticipated by the Cummings reference under 35 U.S.C. § 102(b).

Response to Claim Rejections Under 35 U.S.C. § 103(a)

The following rejections have been applied by the Office:

1. Claims 8, 9, 22, 23, 28, 32 and 34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of U.S. Patent No. 6,380,713 by Namura;
2. Claim 6 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of U.S. Patent Application No. US2002/0036481 by Nagase;
3. Claim 19 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of U.S. Patent Application No. US2005/00300040 by Budnink et al.;
4. Claim 24 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of Namura and Nagase;
5. Claim 25 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view Namura and U.S. Patent No. 6,072,299 by Kurle et al.;

6. Claims 7, 26 and 27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of Namura, Nagase and U.S. Patent No. 6,414,466 by Ida;
7. Claims 14, 16, 20, 29 and 33 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of Namura and U.S. Patent No. 5,703,464 by Karunasiri et al.;
8. Claims 17 and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of U.S. Patent No. 6,232,743 by Nakanishi;
9. Claim 30 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of U.S. Patent Application No. US2007/0141404 by Skidmore et al; and
10. Claim 31 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Cummings in view of Namura and U.S. Patent No. 5,352,968 by Reni et al;

ARGUMENT FOR CLAIM REJECTIONS OF DEPENDENT CLAIMS 6-9, 14, 16-20 AND 22-34 UNDER 35 U.S.C. § 103(a) BASED ON NOVELTY OF CLAIM 1

It is shown above that independent claim 1, as amended, is not anticipated by the Cummings reference under 35 U.S.C. § 102(b). Therefore, any rejections of claims that depend on claim 1, based on the Cummings reference, are not anticipated under 35 U.S.C. § 102(b) and not obvious under 35 U.S.C. § 103(a), since the claims that are dependent on claim 1 incorporate all the limitations of claim 1. Therefore, dependent claims 6-9, 14, 16-20 and 22-34 are not anticipated by the Cummings reference under 35 U.S.C. § 102(b) and not obvious based on the Cummings reference under 35 U.S.C. § 103(a).

ARGUMENT FOR CLAIM REJECTIONS OF DEPENDENT CLAIMS 6-9, 14, 16-20 AND 22-34 UNDER 35 U.S.C. § 103(a) BASED ON THE GRAHAM INQUIRIES

In response to the rejections of applicant's claims 6-9, 14, 16-20 and 22-34 under 35 U.S.C. § 103(a), Applicant provides a summary of the present invention and presents a reasoned

analysis and factual inquiry under the factors presented in *Graham v. John Deere Co. of Kansas City,* 383 U.S. 1 (1966) to establish a case of nonobviousness. The factual inquiries enunciated in *Graham* include:

A. Determining the scope and content of the prior art;

B. Ascertaining the differences between the prior art and the claims in issue;

C. Resolving the level of ordinary skill in the pertinent art; and

D. Evaluating evidence of secondary considerations.

Summary of Applicant's Claimed Invention

Note that this application currently names only one inventor. Therefore, there is no issue or obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made.

In order to understand the invention fully, it is first necessary to identify clearly its object. That is, to assess the condition of a battery by assessing the value of its cold-cranking amperage (CCA). It is also desired that the device operate by measuring a voltage to determine a *near instantaneous* current, and not a current profile. By making an instantaneous measurement, CCA can be determined by drawing an arbitrarily small amount of energy from the battery.

Specifically, the purpose of the invention is *not* to assess the short-circuit current of the battery. Therefore, it is a requirement of a device that embodies the invention that its internal resistance be of a similar order to the resistance into which the CCA will be delivered when starting a vehicle. Therefore, the resistance of the device need not be as low as to mimic a short-circuit of the battery. Moreover, the device is not intended to measure the starter surge current, which the battery may deliver to the starter motor transiently, and which may be significantly greater than the CCA.

The inventor has determined that a suitable FET having a value of R_{ds} that is of the order of 1 milliohm to 3.6 milliohm can be obtained at a cost that is suitably low for use in embodiments of the invention (US$1 to US$3). This compares favourably with the internal resistance of a typical vehicle battery. For example, a battery made to specification DIN 55 has an internal resistance of approximately 24 milliohm while DIN 88 has an internal resistance of approximately 16 milliohm. It must also be remembered that the internal resistance of the battery will increase as it ages (unless, of course, there is an internal short-circuit) so that the influence of the internal resistance of the device diminishes as the battery deteriorates. Note that claim 1 allows that the resistance across which the voltage is measured could be the resistance of the FET itself. No *additional* resistance is required.

In a typical embodiment of the invention, the current that is measured is determined by the internal resistance of the device and the connecting leads (1-2 milliohm) the internal resistance of the device across which the voltage is measured (25 milliohm) and the resistance of the FET (1-3.6 milliohm). Therefore, during measurement, the typical resistance external of the battery will be roughly 28 milliohm, which compares very favourably with the internal resistance of the battery. So, for a DIN55 battery, the typical measurement current will be roughly 230 A, which compares well with the CCA of roughly 420 A.

Note also that the resistor across which the voltage measurement is made may be significantly greater than the resistance of the FET. This allows the designer to fine-tune the measurement current by selection of the value of that resistor such that the findings of the test device most closely reflect the actual real-world performance of the battery. This would not be possible if the voltage measurement were made across the FET.

Another effect of providing a resistor separate from the FET is that most of the energy drawn from the battery during the measurement is absorbed by the resistor (which is relatively robust) rather than the FET (which is relatively vulnerable to damage).

Determining the Scope and Content of the Prior Art

Cummings

The purpose of the discharge circuits 150/250 of Cummings is to discharge the battery with the aim of removing a significant amount of energy stored in the battery. This calls for a draw of current from the battery over a significant period. This is absolutely contrary to the function of the present invention in which it is essential that an absolute minimum of energy is removed from the battery during each measurement cycle.

Although Cummings does not specify the value of the resistance 154/254, it can be deduced that the resistance is chosen such that the amount of current drawn from the battery while being discharged is of a magnitude that will not cause damage to the battery. This implies a resistance that strictly limits the current to be drawn from the battery to avoid the batter being damaged through overheating: the very problem that Cummings' device is to prevent.

It would be a trivialization of the problem to say that it would be a matter of routine choice to use a resistance and time of sampling of the claimed invention in the device of Cummings. The result would be that Cummings' device would no longer work as intended, and would therefore be entirely contrary to the teachings within Cummings' specification. If Cummings' teaching were to be adapted to a device that includes a circuit for significantly discharging a lead-acid battery, then a resistance in the order of milliohm would certainly not be chosen because the currents that would flow would destroy all but a device of extremely robust construction, and would surely destroy the battery.

Ascertaining the Differences Between the Prior Art and the Claims in Issue

Cummings vs. All Claims

The difference in function between the present invention and Cumming's device, and the difference in structure that arises from this, means that a skilled person would not consider its teachings to be of relevance to the problem of measuring CCA of a high-current battery.

Therefore, in contrast with the prior art, the present invention provides:

- near-instantaneous measurement, providing negligible energy dispersion, thereby allowing a low-cost switching device to be used and avoiding the need for a heat sink;
- determination of CCA using Ohm's law, avoiding the need to analyse a measurement profile; and
- use of a measurement resistor separate from the switching means, thereby offering control of current, and reducing the amount of energy dumped into the switching device.

It should be noted that the differences between Applicant's invention and the Cummings reference arise from the fact that the Applicant's claimed invention provides a measure of cold-cranking current or amperage capability of a storage battery without significantly discharging the battery, while the Cummings reference provides a method for preventing overcharging a battery during a charging operation by discharging the battery. Applicant's invention operates by periodically applying a low resistance of the order of 10^{-3} ohms for a momentary time period of the order of 10^{-5} seconds across the battery terminals while measuring the instantaneous current through the low resistance. The instantaneous current through the low resistance is an indication of the cold-cranking amperage or current capacity of the battery. The Cummings references discloses a method to prevent over-charging a battery by discharging a battery on a continuous basis during a battery charging operation, while Applicant's disclosure reveals a method for determining cold-cranking amperage using a short duration, instantaneous current measurement that prevents discharging of a battery.

The Cummings reference discloses a method for preventing over-charging a battery. It accomplishes the over-charge protection by measuring the temperature of the battery, the charging voltage and the charging current during the battery charging process. If the battery temperature, charging voltage and charging current are indicative of an unsafe battery charge level, a shunt circuit is applied across the terminals of the battery until the battery charge level is reduced to a safe level. There is no teaching in the Cummings reference of determining cold-cranking amperage or current of a battery. For operation of the Cummings invention, a battery must be under a charging condition, which is unnecessary in Applicant's invention.

Furthermore, there is no disclosure in the Cummings reference of "characterized in that the switching means is connected in series with a resistance of order 10^{-3} ohms and operates to complete the circuit periodically", as found in Applicant's claim 1. There is also no disclosure in the Cummings reference of "the voltage measurement means operates to measure the potential across the resistance during current flow and thereby determine the current flowing through the resistance using Ohm's law", according to Applicant's claim 1. There is also no disclosure in the Cummings reference of "the period during which the switching means is closed is of the order of 10^{-5} seconds; wherein the current drawn during each closure is of the same order as the short-circuit current of the battery, whereby the instantaneous current determined as flowing through the resistance is indicative of the cold-cranking amperage of the battery" according to Applicant's claim 1. Since there is no disclosure in the Cummings reference of these limitations of Applicant's claim 1, none of the claim rejections of the dependent claims under 35 U.S.C. § 103(a), all of which require the Cummings reference for support, are supported by this reference. Therefore, the claim rejections under 35 U.S.C. § 103(a) are not supported by the Cummings reference and should be withdrawn.

Cummings and Namura vs. Claim 23

Namura shows a casing having an upper and lower portion. Claim 23 comprises a communication means to transmit the processed signal to other display means remotely position from the storage battery. There is no disclosure of claim 23 described in the Namura reference.

Cummings and Nagase vs. Claim 6

Nagase discloses in paragraph [0024] "The current detecting resistor 5 detects a charge/discharge current of the battery 1. The operational amplifier 6 amplifies a small voltage detected by the current detecting resistor 5." The amplifier in Applicant's claim 6 amplifies the voltage across the resistor which detects cold-cranking amperage, not charge/discharge current.

Cummings and Budnink vs. Claim 19

Budnink discloses in paragraph [0046] "When the electrical tester has been inactive for a predetermined period of time (i.e., no AC voltage, DC voltage, or continuity circuit is detected), the microcontroller may turn off port pin PWREN to go to sleep and avoid unnecessary battery drain." Applicant's claim 19 comprises entering a sleep mode in which testing is suspended in the event that the battery EMF remains substantially constant for a predetermined period. Substantially constant EMF is patentably distinguishable from "no AC voltage, DC voltage, or continuity circuit is detected".

Cummings, Namura and Nagase vs. Claim 24

Nagase discloses a LED indicator (page 2, paragraph [0024]) that "indicates the remaining battery capacity". The liquid crystal display device of Applicant's claim 24 is a display means remotely positioned from the storage battery for monitoring the cold-cranking amperage of a storage battery.

Cummings, Namura and Kurle vs. Claim 25

Kurle discloses a display that displays information about the state of a battery that includes its state of charge, need for maintenance, and conditions indicating an end of useful battery life.

The display means of Applicant's claim 25 is for monitoring the cold-cranking amperage of a storage battery.

Cummings, Namura, Nagase and Ida vs. Claims 7, 26 and 27

Ida discloses a Braille indicator (203) driven by an analog-to digital converter (104) for representing a charging voltage and current of a rechargeable battery (201). Ida further discloses the Braille indicator for creating vibrations and sound for use by visually handicapped persons. There is no disclosure of a Braille indicator in Applicant's specification. Applicant's claim 7 claims an analog-to-digital converter for measuring the voltage across the resistance, which represents the battery cold-cranking amperage. Applicant's claim 26 claims a segmented display device for exhibiting a measured value indicative of the cold-cranking amperage condition of a storage battery. Applicant's claim 27 claims a display device capable of displaying one or more icons indicative of the cold-cranking amperage condition of a storage battery.

Cummings, Namura and Karunasiri vs. Claims 14, 16, 20, 29 and 33

Karunasiri discloses an energy management system comprising multiple battery control modules that communicate with one another using a main conductor (16). The disclosed "system can be used for monitoring the performance of, measuring the parameters of, and controlling the operating parameters of batteries…" Applicant can find no disclosure of a vehicle control bus in the Karunasiri disclosure. Applicant's claim 14 claims an electronic control bus of a vehicle for communicating the cold-cranking amperage state of the battery to external apparatus. Applicant's claim 16 claims wireless communication means for conveying the cold-cranking amperage state of the battery to remote locations. Applicant's claim 20 claims a lead-acid storage battery comprising apparatus for monitoring the cold-cranking amperage condition of a storage battery according to claim 1. Applicant's claim 29 claims a battery for use in a motor vehicle, and the display means is adapted to indicate the cold-cranking amperage

condition of the battery during the engine off and indicate the cold-cranking amperage condition of the charging system of the motor vehicle when the engine is in operation, whereby these conditions may be transmitted to remotely positioned display means. Applicant's claim 33 claims a vehicle control bus for transmitting the battery cold-cranking amperage condition to remote display means.

Cummings and Nakanishi vs. Claims 17 and 18

Nakanishi discloses a means for monitoring the output of a battery charging device and instructing a vehicle controller to force the charging device to stop charging when an abnormal battery condition is detected. Applicant's claim 17 claims monitoring the output of a charging device and issuing a warning in the event of a failure of the charging device. Applicant's claim 18 claims monitoring the characteristic output of the charger over time and issues a warning in the event that this suggests whole or partial failure of the charging means.

Cummings and Skidmore vs. Claim 30

Skidmore discloses a fuel cell system comprising a fuel cell stack, energy storage means and a control subsystem, wherein the control subsystem is adapted to monitor the energy storage for leakage and take appropriate action. Applicant's claim 30 claims the electronic circuit adapted for use on a motor vehicle that is capable of detecting leakage of energy from the battery and indicating the same on the display means while the engine is not running.

Cummings, Namura and Reni vs. Claim 31

Claim 31 has been cancelled.

Conclusions

The foregoing detailed analysis of the dependent claim rejections under 35 U.S.C. § 103(a) of Applicant's claims 6-9, 14, 16-20 and 22-34 illustrates the patentably distinct features of Applicant's claims when compared to the references cited by the Office. Therefore, there is no

obviousness under 35 U.S.C. § 103(a) and Applicant requests that the claim rejections be withdrawn.

SUMMARY

In summary, Applicant has amended the claims to further distinguish the claimed invention over the cited references, and presented a reasoned analysis and factual inquiry to establish a case on nonobviousness over combinations of the references cited by the Office. Since the analysis above shows the novel and nonobvious features of applicant's claimed invention in view of the cited references, the Office has failed to establish a *prima facie* case for lack of novelty and obviousness. Applicant requests reversal of all rejections, reconsideration and allowance of the application.

Respectfully Submitted,

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